

# Maintenance Memorandum

**Date:** April 23, 1993

**Subject:** **Guideline for Electrical Traffic Control Device Maintenance**

The attached procedures are currently valid.

Please contact Russ Brinks at (517) 322-3334 or Stu Van Tilburg at (517) 322-3369 for more information.

**Attachment**

“Guideline for Electrical Traffic Control Device Maintenance” 1993: 23 pgs. plus cover

GUIDELINE  
FOR  
ELECTRICAL  
TRAFFIC CONTROL DEVICE  
MAINTENANCE



Michigan Department of Transportation  
Maintenance Division  
1993

This document supersedes all previous guidelines and procedures relative to electrical traffic control device maintenance.

(LAT 04-23-93)

# Guideline for Electrical Traffic Control Device Maintenance

## INTRODUCTION

Traffic control devices must be properly maintained to command respect and to obtain accurate action on the part of motorists. It is the intent of this guide to establish minimum maintenance procedures to accomplish this task.

Department maintenance has been established on a statewide basis utilizing District Signal Electricians. Where local agencies can provide properly trained personnel and equipment, maintenance and/or installation of electrical devices can be undertaken by these agencies when authorized. All other installations are handled by the Lansing Central Signal Shop or by contract.

## SIGNAL MAINTENANCE BY LOCAL AGENCIES

Where local agencies can provide proper personnel and equipment, maintenance and installation of electrical devices can be undertaken by these agencies when authorized. Each individual Signal Cost Agreement form specifies who will be responsible for maintenance, and at what level. Four levels of signal maintenance have been established for local agencies that wish to maintain or install electrical traffic control devices on trunk lines within their jurisdictional area. Each level of maintenance carries with it the responsibility for performing the required maintenance work in the proper manner, and at established intervals. All new installations or modernizations shall be done in accordance with the MDOT Work Authorizations and Standards issued from the Traffic and Safety Division.

Responsibility levels for maintaining and installing are as follows:

- Type A - Requires emergency relamping. Personnel and a vehicle with aerial lift must be available on a 24-hour basis.
- Type B - Requires both routine and emergency relamping, optical unit cleaning, and painting of entire installation. Controller repairs are not authorized. Personnel and a vehicle with aerial lift must be available on a 24-hour basis.
- Type C - Requires both routine and emergency relamping, optical unit cleaning, painting of entire installation, and maintenance of controllers. Personnel must have a working knowledge of controllers, a supply of spare controller parts to allow immediate repairs to controller mechanisms. Personnel must be available on a 24-hour basis.

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Type D - Requires complete routine and emergency maintenance of electrical devices, including controllers. Also requires installation and modernization of all devices as required by Department Work Authorization. Installation equipment and qualified personnel required for installation and maintenance of electrical devices must be available along with a signal shop for fabrication and repair of related materials (controllers, signal heads, etc.).

### SIGNAL MAINTENANCE GUIDELINES - GENERAL

The electrical device maintenance guidelines have been developed for use by the district signal electricians and the various agencies throughout the state who are responsible for maintaining electrical traffic control devices on state trunk lines. The ultimate goal is to insure that a uniform system of maintenance is utilized with respect to all electrical devices that are department responsibility.

It shall be the responsibility of each agency performing electrical device work under a departmental agreement to perform the items described at the agreed level and in the manner as prescribed in this Signal Maintenance Guideline unless otherwise approved. A Maintenance Checklist is also included for use as a quick reference.

#### Relamping

All traffic signal lamps shall be changed at regular intervals. A group lamp replacement shall be used. Adherence to a group lamp replacement will result in a minimum of expenditure of time and funds. A yearly change will be the maximum interval permitted. All incandescent lamps shall be standard A-21 and P-25 traffic signal lamps rated at 125 volts, 8000 hours or greater. Lamp size shall be according to the following guide:

<u>Wattage</u>	<u>L.C.L.</u>	<u>Device</u>
67-69 Watt Series	2-7/16"	8" optical units
67-69 Watt Series	2-7/16"	9" pedestrian units
116 Watt Series	3"	12" pedestrian units
150 Watt - 1950 lum	3"	12" optical units

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Fluorescent lamps as used in "case signs" should be replaced in kind at a maximum one-year interval.

Mercury vapor lamps should be changed at a maximum two-year interval.

### Painting

Signal heads, brackets, poles, control boxes, housing, and conduits above ground shall be repainted at least every four years or as often as may be necessary to prevent corrosion and to maintain good appearance of the equipment. The frequency with which repainting is needed will vary with the paint, condition of the surface to which it is applied, chemicals in the atmosphere and other conditions. Polycarbonate signal heads and PVC conduit should not be painted.

The inside of visors and the entire surface of any louvers shall be painted a dull or flat black to minimize light reflection.

It is essential that vehicular signal heads be painted in colors which contrast with the visible background. Highway yellow best provides this contrast as it has high target value. The motorists must first determine the presence of the signal before they can properly react to its indication. Buildings, commercial lighting and foliage all contribute to the camouflage of the signal head and its indications. On occasions of power failure or lamp burnout, it is vital that the motorist recognize the existence of the signal so that they may take the appropriate action.

For the above reasons, all vehicular signal heads on state trunk line highways shall be painted yellow (color #23538 of Fed. Std. 595A). Where polycarbonate signals are used, do not paint the yellow surfaces. The black inside visors and metal mounting hardware shall be painted. Pedestrian signals shall be painted dark green or flat black (color #37038 of Fed. Std. 595A). Other parts such as brackets, poles, posts, control boxes, housings, and conduits above ground also shall be painted. Aluminum poles and supports may not require painting. All the installations signal heads, and other components shall be repainted at least every four years. Painting may be required more often to maintain a satisfactory appearance.

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### Optical Unit Cleaning

The reduction in brilliance and light output of a signal indication resulting from even a moderate amount of dust and dirt is generally underestimated. Lenses and reflectors should always be cleaned when lamps are replaced unless the last regular cleaning was very recent.

### MAINTENANCE OF CONTROLLERS

#### Controller Timing

Every controller shall be kept in effective operation in strict accordance with its predetermined timing schedule.

A careful check of the correctness of the timing operation of the controller shall be made at least once per year. Also, daylight savings time changes shall be verified. This will insure the controller is operating in accordance with the planned timing schedule. To check the timing, the length of each interval should be recorded for at least two complete cycles. These should then be checked against the timing schedule, a copy of which shall be posted in the control box cabinet. A complete check of traffic actuated equipment should include the checking of the maximum timing by temporarily grounding the detector inputs in the controller. Where the controller is capable of operating in more than one dial, split or offset, each should be independently checked. The checking of offsets can be facilitated by the preparation of a timing table for each controller in the system, and by the operation of the system on a predetermined cycle length during the time that the check is being made.

The checking of most timing functions can be done effectively in connection with periodic preventive maintenance or overhaul. The necessity for checking timing arises from the possibility of mechanical or electrical maladjustments or unauthorized changes of timing. Timing changes should be made only by authorized persons, using written instructions which describe details of each change.

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A sample of a pre-addressed postal card which is sent along with all signal timing permits issued by the Traffic Division Electronic Systems Unit is shown below.

Michigan Department of Transportation 1577 (1/92)		<b>TRAFFIC SIGNAL TIMING RECORD</b> Information required by Act 51 of 1951, as documentation for potential litigation.	
COMPLETE AND RETURN			
FILE REF.		LOCATION	
<input type="checkbox"/> Timing installed as authorized by permit dated:		DATE INSTALLED	
<input type="checkbox"/> Timing NOT installed as authorized. Copy of corrected permit enclosed. Explanation:			
TIMING PERMIT IN CONTROLLER <input type="checkbox"/> Yes <input type="checkbox"/> No		INSTALLED BY	

The purpose of the card is to confirm that the authorized timing was actually installed and also to confirm the date that it was installed. If for some reason the timing cannot be installed, there is room on the card for explanation.

There is also a program of field checking existing signal timing to determine if it conforms with the authorized timing on file in the Electronic Systems Unit. The postal card is used to confirm the field timing. Any random changes in existing signal timing initiated by the district office must be confirmed by memorandum. A new timing permit will then be issued.

The district electricians and the local agencies who are responsible for the installation and maintenance of signal timing should understand the significance of the card and the procedure for completing and returning it to the Electronic Systems Unit.

### Electro-mechanical Controllers

Controller Cleaning and Lubrication - Controllers should be carefully cleaned and serviced at nominal six-month intervals and more frequently if experience proves it necessary. In no event shall the cleaning interval exceed one year. Regularly scheduled preventive maintenance has been found to be more economical than waiting for serious controller trouble to occur.

## Guideline for Electrical Traffic Control Device Maintenance

Preventive maintenance servicing shall include the following steps. Mechanical controllers to be lubricated as shown in the manufacturer's instructions, but lubrication of other controller parts such as sealed bearings should be avoided. Controllers shall be maintained in accordance with manufacturer's service recommendation. Electrical contacts, bearings and wiring to be inspected and any worn or weak parts replaced.

An accuracy check should be made of all timing motors, including synchronous, induction and frequency responsive. Interconnection facilities shall be checked by exercising available timing plans from the master controller.

In the adjustment and overhauling of controllers, the tools recommended by the manufacturer should be used. Availability of a spare unit for each type of controller minimizes the interruption to signal operation when a controller must be removed for routine servicing or emergency repair:

### Solid-State Controllers

This section contains information on troubleshooting and maintenance of the solid state traffic signal controller units by qualified personnel. The technician/electrician has the option to repair a malfunctioning controller unit or return it to the supplier or certified repair facility for service. In either case, the personnel involved should obtain all the information available regarding conditions affecting the controller unit operation. Board repair should be made only by a certified traffic signal technician.

On site maintenance and troubleshooting should be limited to inspection, cleaning, and replacement of modules or units. Refer to the drawings furnished with the terminal facilities for exact detail of the equipment.

- A. Handling - Normal precautions for lifting and transporting electronic equipment should be observed when handling the system units.
- B. Electro-Static Discharge - MOS devices are NOT THE ONLY electronic components that can be damaged by static electricity!



## Guideline for Electrical Traffic Control Device Maintenance

- C. Troubleshooting - An attempt should be made to isolate the operational fault to a specific area of the intersection equipment. If the equipment is on flash due to a tripped malfunction management unit, DO NOT RESET THE MMU but observe and note the intersection condition while the intersection remains on flash. The controller unit at this time will be in stop time, in the position at which the conflict monitor initiated flash. Observe and note the status of controller unit, monitor unit, and detector unit indicators. They should provide a clue as to the source of the problem.

### MAINTENANCE RECORDS

Detailed maintenance records shall be kept and analyzed at regular intervals to determine future policies as to equipment purchases and the maintenance program.

Good maintenance records are valuable in several ways:

1. Careful analysis will assist in determining whether or not the maintenance program in use is satisfactory.
2. Analysis of costs will aid in deciding upon types of equipment to be purchased and improvements in maintenance methods.

Maintenance records shall be kept for all installations and retained for at least seven years. The following information shall be maintained for each trouble call received:

1. Location (Reference number).
2. Date.
3. Time emergency call is received (to nearest minute).
4. Name of individual making request.
5. Description of trouble reported.
6. Name of individual completing service call.
7. Time of starting service work at scene.
8. Time signal back in service and operating in normal manner.
9. Description of actual work performed.

Additional records shall indicate when routine maintenance work is performed.

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### Handling of Trouble Calls

All trouble calls concerning traffic signal installations are to be investigated. It is necessary to undertake any indicated repairs as soon as possible. If for some reason personnel cannot be immediately dispatched to the signal, or travel time is great, it is recommended that the maintaining agency contact law enforcement officials to control traffic. An investigation determining that a general power failure is the cause of a problem requires no further action. Placement of portable generators as a temporary power source should not be undertaken. Possible damage to signal equipment may occur. Temporary stop signs may be placed at the intersection and the controller switched to flash operation. After power is restored, the intersection should be switched back to normal operation.

Response to trouble calls concerning other electrical devices shall be undertaken as soon as work schedules permit, but not later than the next working day unless it is determined that immediate attention is required for public safety. Devices such as flashing beacons, keep right signs, school speed limit signs, warning signs with beacons, sign illuminations, and illuminated case signs are normally of a supplemental nature and can be repaired the next regular working day and as schedules allow.

### General Information

All materials used for maintenance or completion of Departmental work authorizations must meet MDOT specifications unless approval for alternates is obtained from the Department. Specifications are available from the Traffic and Safety Division in Lansing. No work shall be subcontracted without prior approval of the Department. All traffic control devices as required by the Michigan Manual of Uniform Traffic Control Devices shall be utilized during any installation or maintenance activities. Be sure to use adequate safety precautions at the intersection during all maintenance activities.

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When doing installations and modernization work authorizations issued by the Traffic and Safety Division, an Installation Completion pre-addressed postal card (see below) should be completed and returned to the Traffic and Safety Division, Electronic Systems Unit.

Michigan Department of Transportation	<b>ELECTRICAL DEVICES INSTALLATION COMPLETION DATE</b>		
Information required by MDOT to complete billing process.			
<b>COMPLETE AND RETURN</b>			
1531 (11/86)	District: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> Metro		
FILE REF.			
LOCATION			
WORK TO BE PERFORMED BY			
COMPLETION DATE			
CABLE NO.			
WATTAGE CHANGE <input type="checkbox"/> Yes <input type="checkbox"/> NO		UTILITY <input type="checkbox"/> Detroit Edison <input type="checkbox"/> Consumers Power <input type="checkbox"/> Other:	
SIGNATURE		TITLE	DATE

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DISTRICT ELECTRICIAN PROCEDURES - (MDOT USE ONLY)

Scheduled routine maintenance of electrical traffic control devices plus emergency service to keep the devices in serviceable condition.

GOAL: Replace lamps and clean lenses every 12 months. 8000 hour or greater life lamps are used in traffic signal heads. Inspect and service controllers every six months.

Materials

1. Lamps - 8000 hour or greater.
2. Miscellaneous Controller parts as needed.
3. Lint-free rags or paper.
4. Dri-slide lubricant.
5. WD-40
6. Glass cleaner - Windex with Ammonia D® (Drackett Products) or Formula 409® (Clorox Company).  
These are recommended for use on Polycarbonate Lenses.  
DO NOT USE ABRASIVE or SOLVENT type cleaners. This includes cleaners containing alcohol.

Equipment

1. "02" Ladder bucket truck.
2. "10" Aerial bucket (truck will be equipped with two 360° revolving lights with amber globes and will be operating while vehicle is parked in traveled portion of roadway).
3. 6' stepladder.

Controller Maintenance (Average 2 hours per intersection):

1. Controllers should be maintained in strict accord with the manufacturer's instructions.
2. For solid-state controllers, the air filter should be checked and replaced as needed. The thermostat and fan should be checked for proper operation and be free from dirt.
3. All connections should be checked for tightness.
4. Check all grounding wires, clamps, ground rods and surge protectors for good connections.

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5. Check detectors for proper operation of all units. Check loops in the roadway and fill any voids in road surface. Check all lead-in wires. Check for surge protectors and proper grounding.
6. Remove all dirt and dust from inside cabinet.
7. Check that current timing permit is in cabinet.
8. All timing should be checked and verified that it matches the current permit for that location.
9. Electro-mechanical controllers, electrical contacts, bearings and wiring should be inspected and any worn or weak parts replaced.
10. Accuracy check of all timing motors, (including synchronous induction and frequency responsive motors).
11. Inspect cam switch assembly.
12. Clean parts by wiping with a lint-free soft rag.

If repairs cannot be accomplished in the field, replace unit and return unit to shop for overhaul.

### Solid-State Controllers

This section contains information on troubleshooting and maintenance of the solid state traffic signal controller units by qualified personnel. The technician/electrician has the option to repair a malfunctioning controller unit or return it to the supplier or certified repair facility for service. In either case, the personnel involved should obtain all the information available regarding conditions affecting the controller unit operation. Board repair should be made only by a certified traffic signal technician.

On site maintenance and troubleshooting should be limited to inspection, cleaning, and replacement of modules or units. Refer to the drawings furnished with the terminal facilities for exact detail of the equipment.

- A. Handling - Normal precautions for lifting and transporting electronic equipment should be observed when handling the system units.
- B. Electro-Static Discharge - MOS devices are NOT THE ONLY electronic components that can be damaged by static electricity!

Technology trends toward greater complexity, increased density and thinner dielectrics result in parts becoming more sensitive to Electro-Static Discharge damage. Some components can be destroyed or damaged by as little as 20 volts of static electricity.

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Electro-Static Discharge damage can happen anywhere, while trading modules in the field or working on equipment in the shop. (Be Aware: You can inflict Electro-Static Discharge damage by simply touching runners and edge connectors that lead to static sensitive components!!)

To insure that your Solid State Traffic Signal Controller units remain as static free as the day you received it, follow these simple procedures:

1. MINIMIZE HANDLING OF ALL MODULES AND SEMICONDUCTORS. WHEN THEY ARE HANDLED, MAKE SURE IT IS ONLY AT A STATIC-FREE WORK STATION AND PERSONNEL ARE PROPERLY GROUNDED.
  2. KEEP PARTS AND MODULES IN THEIR ORIGINAL CONTAINERS UNTIL YOU ARE READY TO USE THEM.
  3. WEAR A WRIST GROUNDING DEVICE AND MAKE SURE IT IS IN CONTACT WITH THE SKIN; IT IS USELESS IF NOT IN CONTACT WITH THE SKIN AND GROUND. WEAR A WRIST STRAP AT YOUR WORK STATION AS WELL AS WHEN IN A CABINET.
  4. KEEP ALL COMMON PLASTICS OUT OF YOUR STATIC-FREE WORK AREAS, I.E., STYROFOAM CUPS, POTATO CHIP BAGS, CLEAR, WHITE OR NON ANTI-STATIC CUSHIONING AND WRAPS, ETC. THESE ITEMS CAN CAUSE DAMAGE TO STATIC-SENSITIVE DEVICES.
  5. IF YOU ARE RETURNING FAULTY MODULES FOR REPAIR, MAKE SURE THEY ARE INSIDE ANTI-STATIC BAGS. THIS WILL PREVENT ANY ADDITIONAL DAMAGE.
- C. Troubleshooting - An attempt should be made to isolate the operational fault to a specific area of the intersection equipment. If the equipment is on flash due to a tripped malfunction management unit, DO NOT RESET THE MMU but observe and note the intersection condition while the intersection remains on flash. The controller unit at this time will be in stop time, in the position at which the conflict monitor initiated flash. Observe and note the status of controller unit, monitor unit, and detector unit indicators. They should provide a clue as to the source of the problem.

Every effort should be made to obtain all the information possible, this includes the conditions under which the controller is operating, such as 1) the controller unit settings, 2) mode of operation, 3) external conditions that affect the controller, and 4) time of day the problem occurs.

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The nature of the problem also should be noted, such as 1) if the controller is "hung-up", note in what interval and whether or not the hangup occurs every cycle, 2) if the controller is omitting an interval, note under what conditions, e.g., only when an external command is applied, etc., and 3) improper signal indications on the same phase, such as conflicting conditions.

If the problem is isolated to the terminal facilities, inspect for evidence of damage (i.e., loose or burned terminals, broken wires). Repair or replace as necessary.

When the problem is determined to have occurred within the controller unit or other plug-in devices, replace the device with a spare and return the defective unit and your notes to the shop for further testing.

If the technician/electrician chooses to return the defective module or complete unit for service, all of the above information should accompany the unit or module. This information will help the technician to isolate the cause of the malfunction.

### Flash Controller Maintenance (Average 1 hour per controller):

1. Check all connections, grounding wires, ground rods and surge protectors.
2. Mechanical flashers should be replaced with a NEMA flasher unit.
3. Remove all dirt and dust from cabinet.
4. Clean parts by wiping with a lint free soft rag.

### Traffic Signal Relamping Maintenance (Average forty-five minutes to one hour per intersection):

Lamps shall be standard A-21, 69W, 8000 hour, 130 volt for 8 inch traffic signals, beacons and 8/9 inch pedestrian signals.

Lamps shall be standard P-25 1950 lumens, 8000 hour, 130 volt for 12 inch traffic signals.

All lamps shall be clear traffic signal type meeting ITE standards and have brass bases.

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1. Clean outside of lens and underside of visors.
2. Remove lamps and clean reflectors.
3. Check lamp sockets.
4. Wipe inside of lens.
5. Check lens gaskets.
6. Inspect wiring.
7. Screw in lamps with open part of filament up and make sure they are operative before closing heads.
8. Visual inspection of signal head, mounting span clamp, span clamp pin, and miscellaneous fittings.
9. Check height (15'6" bottom height minimum) and alignment.
10. Use a suitable lubricant if the hinges are sticking.
11. Clean up area of any litter you may have made.
12. Complete maintenance records (intersection signal equipment record).
13. Analyze signal at regular intervals to plan future maintenance requirements.

### Pedestrian Signal Relamping Maintenance (Average 30-40 minutes per intersection):

Lamps shall be standard A-21, 69 watt, 8000 hour traffic signal lamp rated at 130 volts for 9/10 inch pedestrian signals.

Lamps shall be standard A-21, 116 watt, 8000 hour, 130 volt for 12 inch pedestrian signals.

All lamps shall be clear traffic signal type meeting ITE standards and have brass bases.

1. Clean outside of lens and underside of visors.
2. Remove lamps and clean reflectors.
3. Check lamp sockets.
4. Wipe inside of lens.
5. Check lens gaskets and lens holding corner brackets. Make sure equal pressure is applied to all four corners.
6. Screw in lamps with open part of filament up and make sure they are operative before closing head.
7. Visual inspection of pedestrian head, mountings and miscellaneous fittings.
8. Use a suitable lubricant if the hinges are sticking.
9. Clean up area of any litter you may have made.
10. Complete maintenance records (intersection signal equipment record).
11. Analyze signal at regular intervals to plan future maintenance requirements.



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### Signal Trouble Calls:

Make necessary repairs or temporary repairs until planned maintenance can be accomplished.

An Electrical Devices Trouble Report (Form 499) will be prepared each time a trouble call is received by the Signal Shop during normal working hours or by the Electrician after normal working hours. This report will be filed with the appropriate signal job report.

Detailed maintenance records (intersection signal equipment record) shall be kept and analyzed at regular intervals to determine future maintenance program.

### Controller Timing:

Every controller shall be kept in effective operation in strict accordance with its predetermined timing schedule.

A careful check of the correctness of the timing operation of the controller shall be made at least once per year. Also, daylight savings time changes should be verified. This will insure the controller is operating in accordance with the planned timing schedule. To check the timing, the length of each interval should be recorded for at least two complete cycles. These should then be checked against the timing schedule, a copy of which shall be posted in the control box cabinet. A complete check of traffic actuated equipment should include the checking of the maximum timing by temporarily grounding the detector inputs in the controller. Where the controller is capable of operating in more than one dial, split or offset, each should be independently checked. The checking of offsets can be facilitated by the preparation of a timing table for each controller in the system, and by the operation of the system on a predetermined cycle length during the time that the check is being made.

The checking of most timing functions can be done effectively in connection with periodic preventive maintenance or overhaul. The necessity for checking timing arises from the possibility of mechanical or electrical maladjustments or unauthorized changes of timing. Timing changes shall be made only by authorized persons, using written instructions which describe details of each change.

## Guideline for Electrical Traffic Control Device Maintenance

A sample of a pre-addressed postal card that is sent along with all signal timing permits issued by the Traffic Division, Electronic Systems Unit is shown below.

Michigan Department of Transportation 1577 (1/82)		TRAFFIC SIGNAL TIMING RECORD	
		Information required by Act 51 of 1951, as documentation for potential litigation.	
COMPLETE AND RETURN			
FILE REF.	LOCATION		
<input type="checkbox"/> Timing installed as authorized by permit dated:		DATE INSTALLED	
<input type="checkbox"/> Timing NOT installed as authorized. Copy of corrected permit enclosed. Explanation:			
TIMING PERMIT IN CONTROLLER <input type="checkbox"/> Yes <input type="checkbox"/> No		INSTALLED BY	

The purpose of the card is to confirm that the authorized timing was actually installed and also to confirm the date that it was installed. If for some reason the timing cannot be installed, there is room on the card for explanation.

There is also a program of field checking existing signal timing to determine if it conforms with the authorized timing on file in the Electronic Systems Unit. The postal card is used to confirm the field timing. Any random changes in existing signal timing initiated by the district office must be confirmed by memorandum. A new timing permit will then be issued.

The district electrician should understand the significance of the card and the procedure for completing and returning it to the Electronic Systems Unit.

### General Information

Adequate safety precautions shall be used during all maintenance activities.

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## MAINTENANCE CHECKLIST

The following sections provide general guidelines to aid the signal electrician or technician in the performance of the individual tasks. Specific requirements unique to each manufacturer as provided in the manufacturers' maintenance manuals should be followed.

Where there are no manufacturer's maintenance recommendations, the minimum preventive maintenance tasks and time intervals summarized in Table 1 can be used as a guide. As shown, preventive maintenance tasks should be performed on detector equipment every 3 months; on signal controller cabinets, signals, and related equipment at 6 or 12 month intervals; on controller equipment generally on an annual basis. Repainting of cabinets, signal heads, poles, and mast arms is recommended every 2 to 5 years.

TABLE 1  
Preventive Maintenance Checklist

TASK	<u>Recommended Interval</u>			
	<u>Months</u>			<u>Years</u>
	3	6	12	2 to 5
Cabinet (per unit)				
*lubricate hinges and lock			x	
*clean filters	x			
*replace filters			x	
*check weatherproof seal (gasket)			x	
*check anchor bolts			x	
*check for water accumulation and duct sealant			x	
*check ground rod clamp and wire			x	
*check wiring schematics and records	x			
*check operation of fan and heater	x			
*check radio interference filter and lightning arrester			x	
*check circuit breaker	x			
*check ground fault receptacle	x			
*measure voltages at service inputs in cabinet	x			
*check and record current being drawn	x			
*repaint exterior (if originally painted)				x
*snow removal			As necessary	

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TASK	Recommended Interval			
	Months			Years
	3	6	12	2 to 5
Signal Heads (per unit)				
*clean lenses, signs, and reflectors			x	
*replace lamps			x	
*check alignment		x		
*check for wear on the span wire, signal wire and mechanical hardware (clevis pins, clamps)			x	
*check mast arms, free swinging signals; check clevis and chain			x	
*check for cracks or rust in the hardware			x	
*check for bent hoods, wing nuts, hinges			x	
*replace substandard parts			x	
*replace defective lenses and reflectors			x	
*check locking ring (surface); install proper locking devices as required			x	
*check condition of back plates (if used)			x	
*repaint exterior of signal (if originally painted)				x
*perform nighttime check for visibility		x		
Mast Arms and Poles (per unit)				
*inspect for rust and spot paint as required			x	
*inspect joints for rust and cracks at arm/upright location and at base plate			x	
*inspect anchor bolts for rust and tightness			x	
*inspect horizontal and vertical angle of the arm			x	
*repaint exterior (if originally painted)				x
Span Wire and Poles (per unit)				
*inspect poles			x	
*check span wire			x	
*check clamps and hardware			x	
*check guy wire, anchors, and guards			x	
Push Buttons (per unit)				
*check and actuate push buttons on each end of actuated crosswalks and visually verify pedestrian signal operation; verify timing			x	
*check push button lamp (if one exists) for operation			x	
*check push button signs; clean or replace if necessary			x	
*check push button sign alignment			x	

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TASK	<u>Recommended Interval</u>			
	<u>Months</u>			<u>Years</u>
	3	6	12	2 to 5
Detectors (per approach)				
Sensors				
*visually inspect roadway along loop detector saw cut for exposed wires, cracks, potholes, etc.			x	
*check alignment for sonic, magnetic, and radar type detectors; verify call inputs to controller phases			x	
*check anchorage for pressure detector frame and contact units			x	
Amplifiers				
*check if the detector is detecting vehicles within its design zone of detection			x	
*tune the detector if necessary			x	
*check if the connectors are tight and secure			x	
Junction Boxes and Handholes (per unit)				
*check integrity of the splices			x	
*check the ground rod and clamp connection, and bonding of conduits			x	
*check the insulation				x
*check for abnormal amount of water				x
*check lid for abnormal condition and fit				x
Electromechanical Control Equipment (per unit)				
Dial Assembly				
*Check for wear on key follower				x
*check for burned, pitted, or discolored contacts				x
*check for key positions				x
*check for cycle gear size and mesh				x
*check dial motor operation				x
*check all dials according to manufacturer's recommendations				x
*if controller is part of a system, check offset				x
*check duration of the advance pulse				x

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TASK	Recommended Interval			
	Months			Years
	3	6	12	2 to 5
Cam Assembly				
*check for end play				x
*clean and lubricate as required by manufacturer				x
*visually inspect for abnormal wear or cracks				x
*check for burned, pitted, or discolored contacts				x
*check spring tension on contacts				x
*check for loose wiring to contacts				x
*check for operation of advancing mechanism to conform with manufacturer's requirements				x
*check if all connections are secure and tight				x
*visually inspect wires for wear, rubbing, deterioration of insulation				x
*install dust cover as required				x
Relays				
*check for burned, pitted, or discolored contacts				x
*check for tight and secure fit into the sockets				x
*for latch-type relays, check for latch operation per manufacturer's recommendations				x
Flashers				
*check flash rate				x
*check operation				x
*check for burned, pitted, or discolored contacts				x
*check for tight and secure fit into the sockets				x
Switches				
*verify operation of each switch position				x
Terminal Connections				
*check visually for signs of corrosion or any abnormal condition				x
*tighten all terminal connections				x

Guideline for Electrical Traffic  
Control Device Maintenance

TASK	Recommended Interval			
	Months			Years
	3	6	12	2 to 5
Solid State, Analog, and Microprocessor-based Control Equipment (per unit)				
General				
*check if the time settings match the current timing permit			x	
*check if all indicator lamps on the modules working; replace failed lamps				x
*check for extension by detector actuation				x
*check if modules are fitting tight and secure into the frame				x
*check if connectors are tight and secure				x
*wipe dust off controller, detectors, and auxiliary equipment				x
Load Switches				
*check if load switch packs are fitting tight and secure into their chassis				x
Auxiliary Logic				
*check operation				x
Relays				
*check for burned, pitted, or discolored contacts				x
*check mercury relays (if used) for excessive splash				x
Flashers				
*check if firm in socket; check on/off ratio and flash rate				x
Switches				
*check for loose wires				x
Terminal Connections				
*check for discoloration and tightness				x

Guideline for Electrical Traffic  
Control Device Maintenance

TASK	<u>Recommended Interval</u>			
	<u>Months</u>			<u>Years</u>
	3	6	12	2 to 5
Interconnected Equipment (per unit)				
*check if controller operates in the mode selected by the supervisory master (i.e., time based coordinator)			x	
*disconnect from the master supervisory system and check for "free" or backup operation			x	
*check any special equipment per manufacturer's recommendations				As required
Miscellaneous				
*record all changes in timing, wiring, or any function				As required
*record current flow at unmetered installations				As required

RESPONSE TIME

The initial response time to investigate a reported problem intersection and verify and identify the problem should not exceed two hours. This initial verification can be performed by the police in emergency situations. Following verification, either a final repair or emergency repair - depending on the nature of the equipment problem - should be performed as follows:

- \* Final Repair entails complete repair or replacement of failed equipment to restore the intersection to proper and safe operation in accordance with permit specifications within a 24-hour period.
- \* Emergency repair temporarily restores safe operation within a 24-hour period. Final repair to bring the equipment into conformance with the permit specifications should be completed within 30 days unless prohibited by weather conditions or unavailability of equipment.



# Guideline for Electrical Traffic Control Device Maintenance

Table 2 presents a recommended list of final versus emergency repairs for common major problems. As shown, final repair is recommended for span wires or signal heads knocked down due to an accident or weather, and for lamp burnout and failures of the conflict monitor, flasher, load switch/relay, or signal cable. For other types of failures, emergency repair is usually acceptable. The most important consideration is that a consistent repair response time be provided, regardless of the sophistication of the equipment.

TABLE 2  
Repair List of Major Items

	<u>Recommended Type of Repair</u>
<b>Knockdowns</b>	
*Support - mast arm	Emergency or Final
*Support - strain pole	Emergency or Final
*Strain wire/tether only	Final Only
*Pedestal	Emergency or Final
*Cabinet	Emergency or Final
*Signal heads	Final Only
<b>Equipment Failure or Malfunction</b>	
*Lamp burnout (vehicle & pedestrian)	Final Only
*Local controller	Emergency or Final
*Master controller	Emergency or Final
*Detector sensor	
Loop	Emergency or Final
Magnetometer	Emergency or Final
Sonic	Emergency or Final
Magnetic	Emergency or Final
Push Button	Emergency or Final
*Detector amplifier	Emergency or Final
*Conflict monitor	Final Only
*Flasher	Final Only
*Time switch	Emergency or Final
*Load switch/relay	Final Only
*Coordination unit	Emergency or Final
*Communication interface, modem	Emergency or Final
*Signal cable	Final Only